Lecture 7: Growth Theory III: Why Doesn't Capital Flow From Rich Countries to Poor Countries?

See Lucas 1990

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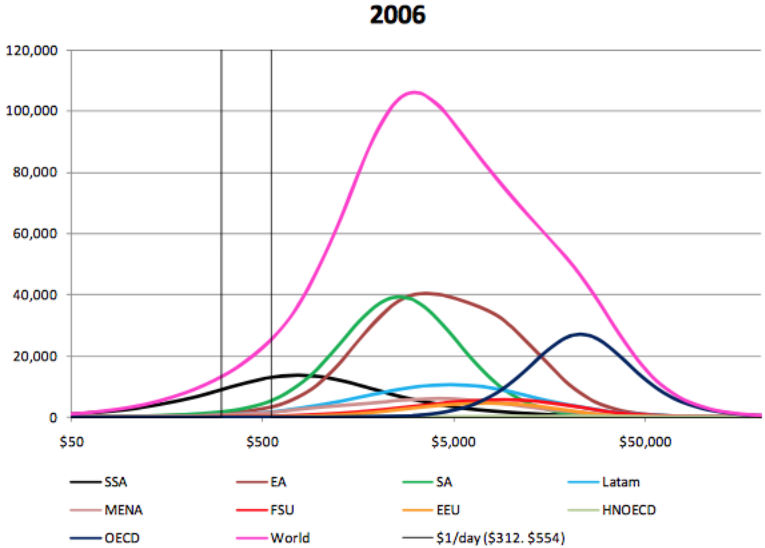
Motivation-I

- We've seen the Solow Growth model
- We've seen what it can and can't do
  - Strong prediction of convergence
  - Framework for explaining failures of convergence
  - Rules out capital and labor increasing as main causes of growth
- Can it explain why capital doesn't flow from rich to poor countries?
- i.e. respond to the claim that rich countries only produce a lot because they have the capital

Motivation-II



Idea

- When Lucas wrote, U.S. production per person 15x India production per person
- Simple Cobb-Douglas production function (per worker):

$$y = Ak^{\alpha}$$

- Where
  - y is production per person
  - A is productivity
  - k is capital per person
- What is true of marginal product with respect to k as k rises?

Idea

- When Lucas wrote, U.S. production per person 15x India production per person

- Production function per worker

$$y = Ak^{\alpha} \qquad or \qquad k = A^{-\frac{1}{\alpha}} y^{\frac{1}{\alpha}}$$

- Marginal product of capital:

$$r = \alpha A k^{\alpha - 1}$$

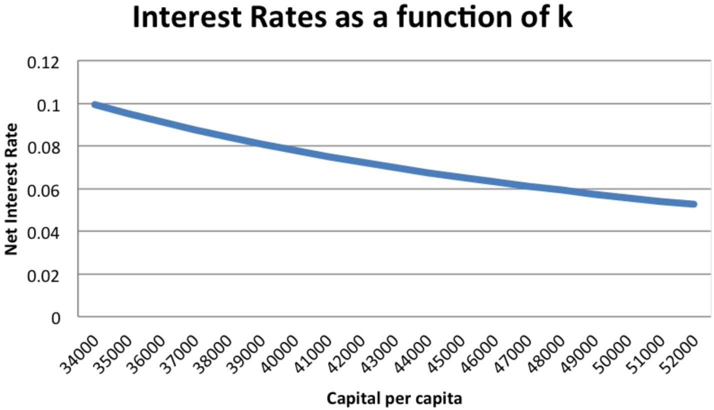
- Plug in k in terms of y:

$$r = \alpha A^{\frac{1}{\alpha}} y^{\frac{\alpha - 1}{\alpha}}$$

Numerical Calibration

- Assume that A is the same, $\alpha = 0.4$.
- $y^{U.S.} = 15 y^{India}$
- Let's look at what the interest rate should look like as a function of capital

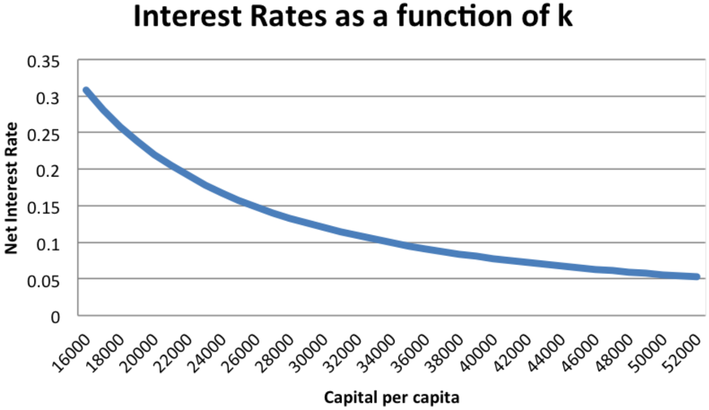
Idea-II



Calibrate A to get a reasonable interest rate for the United States

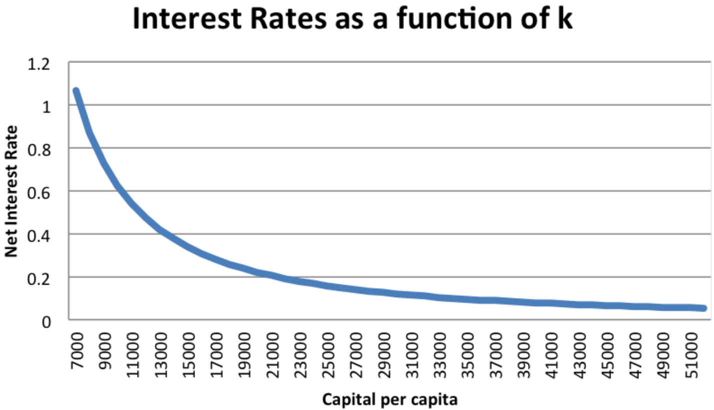
Now, let's look at poorer countries marginal product of capital

Idea-II



Interest Rates as a function of k
Net Interest Rate
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
16000
18000
20000
22000
24000
26000
28000
30000
32000
34000
36000
38000
40000
42000
44000
46000
48000
50000
52000
Capital per capita

Idea-II


Interest Rates as a function of k
Net Interest Rate
1.2
1
0.8
0.6
0.4
0.2
0
7000
9000
11000
13000
15000
17000
19000
21000
23000
25000
27000
29000
31000
33000
35000
37000
39000
41000
43000
45000
47000
49000
51000
Capital per capita

Numerical Analysis

- When Lucas wrote, U.S. production per person 15x India production per person
- Production function per worker

$$\frac{r^{U.S.}}{r^{India}} = \frac{\alpha A^{\frac{1}{\alpha}} \left(y^{U.S.}\right)^{\frac{\alpha-1}{\alpha}}}{\alpha A^{\frac{1}{\alpha}} \left(y^{India}\right)^{\frac{\alpha-1}{\alpha}}}$$

- Cancelling, and Plugging in $y^{U.S.} = 10y^{India}$:

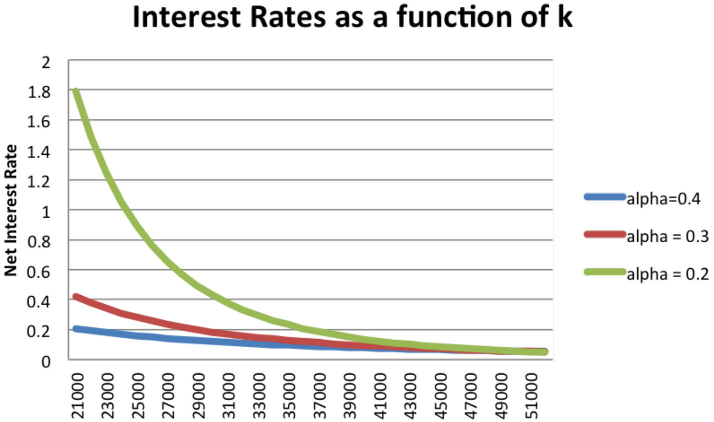
$$\frac{r^{U.S.}}{r^{India}} = 15^{\frac{\alpha-1}{\alpha}}$$

- If $\alpha = 0.4$, then

$$\frac{r^{U.S.}}{r^{India}} = 0.03$$

- Which means that the U.S. interest rate is about 1.7% that of India's.
- Remember, capital flows rapidly to even quite minor differences, let alone this!

Different α's



Idea

- It isn't about α
- Could it be about us improperly counting workers?
- Lucas, borrowing from Anne Krueger: what if one U.S. worker was like 5 Indian workers?
- Rather than 15 times more production "per worker" it's really only 3 times production per effective worker
- Doesn't resolve the problem:

$$\frac{r^{U.S.}}{r^{India}} = 0.19$$

- U.S. interest rates are still only 1/5th of India's...capital should still flow *quickly* to India

Putting human capital into the production function

- Let's put human capital h into the production function

$$y = Ak^{\alpha}h^{\beta}$$

- Then the marginal product of capital is:

$$y = \alpha Ak^{\alpha-1}h^{\beta}$$

- Or the interest rate, in terms of y, is:

$$r = \alpha A^{\frac{1}{\alpha}}y^{\frac{\alpha-1}{\alpha}}h^{\frac{\beta}{\alpha}}$$

- Lucas estimates $\gamma \approx 0.36$. What does this mean?
- Increase human capital of those around you by 1%, your production goes up by 0.36%.
- Now let's use this

Numerical Analysis, Revisited

- Same, but $\beta = 0.36$, $h^{U.S.} = 5h^{India}$, and $y^{U.S.} = 3y^{India}$
- Interest rates:

$$\frac{r^{U.S.}}{r^{India}} = \frac{\alpha A^{\frac{1}{\alpha}} \left(y^{U.S.}\right)^{\frac{\alpha-1}{\alpha}} \left(h^{U.S.}\right)^{\frac{\beta}{\alpha}}}{\alpha A^{\frac{1}{\alpha}} \left(y^{India}\right)^{\frac{\alpha-1}{\alpha}} \left(h^{India}\right)^{\frac{\beta}{\alpha}}}$$

- Cancelling, and Plugging in $y^{U.S.} = 3y^{India}$ and $h^{U.S.} = 5h^{India}$

$$\frac{r^{U.S.}}{r^{India}} = \frac{\left(3y^{India}\right)^{\frac{\alpha-1}{\alpha}} \left(5h^{India}\right)^{\frac{\beta}{\alpha}}}{\left(y^{India}\right)^{\frac{\alpha-1}{\alpha}} \left(h^{India}\right)^{\frac{\beta}{\alpha}}}$$

- Becomes

$$\frac{r^{U.S.}}{r^{India}} = 3^{\frac{\alpha-1}{\alpha}} 5^{\frac{\beta}{\alpha}} = 0.192 \cdot 4.26 = 0.8$$

- Where if $\beta = 0.4$ rather than 0.36, we would have gotten:

$$\frac{r^{U.S.}}{r^{India}} = 1.04$$

Thinking about the results-I

- Production function

$$y = Ak^{\alpha}h^{\beta}$$

- Note that A and h^{β} do the same thing!

$$y = A^{*}k^{\alpha} \qquad A^{*} = Ah^{\beta}$$

- We're really just estimating human capital's contribution to TFP

- Two contributions
  - Direct contribution of being more productive (∼5x)
  - Indirect contribution of fellow workers being more productive (∼4x)
- The name of the game is productivity

Thinking About Capital Markets

- We are talking about capital, but capital may take many forms
- Really, we're saying there's a two-step process we should see in trade flows
  1. Things (capital goods) flow from rich to poor countries
  2. Then, things (capital goods, consumption goods) flow from poor to rich countries, forever
- What's the obvious & easy thing for the poor country to do? When should they stop repayment?
- Consequently, what should rich countries do?
- Is risk of getting paid back a good explanation for why funds shouldn't flow?
- Probably not...think of

Model a Colonial Power-Idea

- Imperial power has complete control over trade to and from a colony
- Colony has no capital goods of its own, save through imperial power
- But, labor market is free
- Imperial power can therefore choose k, capital per worker
- What level of k should imperial power choose?

Model a Colonial Power

- Colonial production function is (per-person):

$$y = f(k)$$

- And profit is:

$$\pi = y - w - rk$$

- Recall that w depends on k:

$$w = \frac{\partial Y}{\partial L} = \frac{\partial L f(k)}{\partial L} = \frac{\partial L f\left(\frac{K}{L}\right)}{\partial L}$$
$$= f(k) - f'(k)\frac{K}{L^2}L$$
$$= f(k) - f'(k)k$$

- Plug in $f(k) = Ak^\alpha$:

$$w = Ak^\alpha - \alpha A k^{\alpha-1} k$$
$$= (1-\alpha)Ak^\alpha$$

- The more production per capita, the higher the wages!

Model a Colonial Power-II

- So we can write profit as:

$$\pi = f(k) - (f(k) - f'(k)k) - rk$$

- Does the monopolist want to maximize total production? No! more capital raises wages!

$$f'(x) = r - xf''(x)$$

- Maximize:

$$\pi = f'(k)k) - rk$$

  Taking FOC's:

$$f'(k) = r - f''(k)k$$

- Normally, you think that $f'(k) = r$, the MPK is equal to the MC. But when the cost to the imperial power includes increased wages (the last term) then we should have a little less capital, reducing wages via a monopsony-like power.

- Perhaps this is why third world governments, cabals, and dictators restrict capital inflows!

Conclusions

- Much of development economics concerns itself with how to get capital flows to poor countries
- If our calculations are right, the problem is one of productivity
- If the problem is political risk limiting inflows, then it may be some monopolistic rents are being accrued
- Possible tying aid to openness to foreign investment on competitive terms would be good.